B. Claims

The listing of all claims in the application is provided.

1. (Original) A processing method for forming an insulated film on a surface of a substrate to be processed, through an oxynitriding treatment, said processing method comprising the steps of:

nitriding a surface of the substrate by irradiating plasma containing nitrogen atoms onto the substrate; and

oxidizing the surface of the substrate, which has been nitrided, by irradiating plasma containing oxygen atoms.

2. (Original) A processing method according to claim 1, wherein said nitriding and oxidizing steps place the substrate on a susceptor, a temperature of the susceptor being maintained at 600 °C or lower.

3. (Original) A processing method according to claim 1, wherein said substrate include silicon, and said nitriding and oxidizing steps control a process time so that the insulated film has an effective oxide thickness of 3.0 nm or smaller.

4. (Original) A processing method according to claim 1, wherein said nitriding step uses, as process gas, gas that includes at least one of $N_2$, $NH_3$ and $N_2H_4$ or the one which is diluted with at least one of He, Ne, Ar, Kr and Xe, mixed gas of $H_2 + N_2$ or the one which is diluted with at least one of He, Ne, Ar, Kr and Xe.

5. (Original) A processing method according to claim 1, wherein said oxidizing step gas uses, as process gas, gas that includes at least one of $O_2$, $O_3$, $H_2O$, and $H_2O_2$ or the one which is diluted with at least one of He, Ne, Ar, Kr, Xe and $N_2$.

6. (Original) A processing method according to claim 1, wherein said oxidizing step sets ion energy to be 5 eV or smaller incident to the substrate from the plasma.

7. (Original) A processing method according to claim 1, wherein said substrate includes silicon, and said oxidizing step controls an oxygen atom concentration so that a nitrogen atom concentration is 5 % or smaller at a position near an interface between the silicon and a silicon oxynitride film in the insulated film.

8. (Original) A processing method according to claim 1, wherein said nitriding step controls a process time so that the insulated film contains the nitrogen atoms between $3 \times 10^{14}$ $cm^{-2}$ and $1.5 \times 10^{15}$ $cm^{-2}$ that is converted into a surface density.